Introduction

Efforts by cultural heritage institutions to increase awareness of their digital collections have led them to find creative ways to reach users. One method for increasing access to digital special collection, archive, and museum holdings that has seen increasing popularity is the addition of digital cultural heritage materials and links to Wikimedia projects including Wikimedia Commons and Wikipedia. However, existing literature detailing the process and results of such strategies centers primarily on the work of large research institutions and focuses on web analytics to show the success of such projects. It is unclear if smaller institutions with niche and focused collections will see massively increased traffic to their websites and digital libraries as many of these programs have reported. There is also little evaluation of other means of impact for cultural heritage institutions linking their holdings to Wikimedia products, such as reuse of images or information published to Wikimedia by cultural heritage institutions. In order to contribute to the knowledge gap in this area of research, this article details a case study in linking and uploading digital assets from a medium sized liberal arts college to Wikimedia projects, and assesses impact via web traffic, wiki reuse, and image reuse. The details of this research include concrete examples which should allow for easily reproducible assessment strategies for other institutions to implement.

Literature Review

Cultural heritage institutions with digital resources, ranging from digitized collections to online finding aids, have shifted their priorities from restricting collection access to expanded openness and "broadest use" as a result of growing Web 2.0, or social web, technologies.[1] One strategy for increasing access to digital cultural heritage resources is the addition of links or uploaded media to the Wikimedia environment. Outside of the cultural heritage sector, adding public domain and open-licensed images to Wikimedia Commons, the media repository for all Wikimedia products, has been promoted as an effective Search Engine Optimization strategy for marketers.[2] This is supported by a 2012 study in the United Kingdom that found that over half of noun searches in Google pointed to a Wikipedia page as the first result and that 99% of these searches included a Wikipedia entry on the first page of results.[3]

Cultural heritage institutions have been experimenting with promoting their collections through the Wikimedia environment for over a decade now, sometimes with extraordinary results. The

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[1] George Cooban, "Should Archivists Edit Wikipedia, and If so How?," *Archives & Records* 38, no. 2 (September 2017): 257–72, https://doi.org/10.1080/23257962.2017.1338561.

[2] Lise Broer, "An Untapped SEO Opportunity: Image Link Love From Wikipedia," Search Engine Land, September 11, 2007, https://searchengineland.com/an-untapped-seo-opportunity-image-link-love-from-wikipedia-12136.

[3] Sam Silverwood Cope, "Wikipedia: Page One of Google UK for 99% of Searches," *Pi Datametrics* (blog), February 8, 2012, https://www.pi-datametrics.com/wikipedia-page-one-of-google-uk-for-99-of-searches.

following is a brief timeline of Wiki-related projects that cultural heritage institutions have undertaken using their digital resources:

- The University of Washington Libraries Digital Initiatives unit worked with students to add digital collections links to Wikipedia, resulting in an upward trend in referrals from Wikipedia to the institution's digital collections[4]
- Graduate students at Villanova University authored new Wikipedia articles and linked those as well as existing articles to digital collections of personal papers[5]
- The University of North Texas received almost half of its referring traffic from Wikipedia after creating direct links from 700 articles to digital objects[6]
- The University of Las Vegas Nevada saw consistent traffic to their website and digital collections after linking them from Wikipedia[7]
- An intern for Calisphere, part of the California Digital Library, added digital collection links to Wikipedia and also found existing links and Wikimedia Commons uploads from Calisphere, providing a glimpse of which resources Calisphere users find most useful[8]
- Wake Forest Libraries have added internal and external digital collection links to Wikipedia[9]
- Syracuse University Special Collections professionals edited existing Wikipedia articles related to their holdings for accuracy and created new articles for notable people and organizations, adding links to finding aids in the External Links section along the way and tripling their web traffic[10]
- After hiring their first Wikipedian-in-Residence, the National Archives' Daily Document received 12 million "hits" on Wikipedia, in contrast to several thousand "hits" on the National Archives website[11]
- The University of Houston initially focused on adding digital collection links to Wikipedia articles until realizing that uploading images directly to Wikimedia Commons

[4] Ann M. Lally and Carolyn E. Dunford, "Using Wikipedia to Extend Digital Collections," *D-Lib Magazine* 13, no. 5/6 (June 5, 2007): 1–1.

[5] Teri Ann Incrovato, "The Digital Library @ Villanova University and Wikipedia," *Compass: Falvey Memorial Library Newsletter*, November 2007, http://newsletter.library.villanova.edu/220.

[6] Dreanna Belden, "Harnessing Social Networks to Connect with Audiences," *Internet Reference Services Quarterly* 13, no. 1 (February 5, 2008): 99–111, https://doi.org/10.1300/J136v13n01_06.

[7] Darcy Del Bosque et al., "Discovering Places to Serve Patrons in the Long Tail," *Library 2.0 Initiatives in Academic Libraries*, January 1, 2008, 1–15.

[8] Lena Zentall and Camille Cloutier, "The Calisphere Wikipedia Project: Lessons Learned: Monroe Library QuickSearch," *CSLA Journal* 32, no. 1 (2008): 27–29.

[9] Lauren Pressley and Carolyn J. McCallum, "Putting the Library in Wikipedia," *Online* 32, no. 5 (2008): 39–43.

[10] Michelle Combs, "Wikipedia as an Access Point for Manuscript Collections," in *A Different Kind of Web: New Connections between Archives and Our Users* (Chicago: Society of American Archivists, 2011), 139–47.

[11] David S. Ferriero, "On the Growing Relationship Between the National Archives and Wikipedia," *Vital Speeches of the Day* 77, no. 10 (October 2011): 367–69.

resulted in the proliferation of these images among Wikimedia projects and increased traffic to their website and digital resources. This led to Wikimedia projects serving as the top referring website to the university's digital collections[12]

● A Ball State University project to add digital sheet music links to Wikipedia saw an over 600% increase in pageviews for the individual items linked, and a tripling of pageviews for the entire digital collection[13]

● Ohio University introduced their special collections to composition students with the goal of students authoring or editing Wikipedia articles related to the university's collections[14]

● The University of Pittsburgh saw an increase in online finding aid, digital collection usage, and possibly even email reference after links to their digital assets were added to Wikipedia articles[15]

● Texas Tech University saw an increase in digital collection traffic when links were added to Wikipedia; after adding one digital image to a Wikipedia page, over the course of almost three years 22% of traffic to this item in the institution's digital collection came from Wikipedia[16]

● An attempt to determine overall impact of digital items from the Imperial War Museum Collections on Wikimedia Commons involved analysis of image occurrences, page views for articles and media pages, and analysis of size and position on page for images. The study found that images were much more likely to be viewed on Wikipedia articles than directly in Wikimedia Commons[17]

The Wikipedia project page on the GLAM-Wiki Initiative ("galleries, libraries, archives, and museums" with Wikipedia) further details successful collaborations between cultural heritage institutions and Wikipedians.[18]

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[12] Danielle Elder, R. Niccole Westbrook, and Michele Reilly, "Wikipedia Lover, Not a Hater: Harnessing Wikipedia to Increase the Discoverability of Library Resources," *Journal of Web Librarianship* 6, no. 1 (January 2012): 32–44, https://doi.org/10.1080/19322909.2012.641808.

[13] Michael Szajewski, "Using Wikipedia to Enhance the Visibility of Digitized Archival Assets," *D-Lib Magazine* 19, no. 3/4 (April 3, 2013): 9–9, https://doi.org/10.1045/march2013-szajewski.

[14] Matthew Vetter and Sara Harrington, "Integrating Special Collections into the Composition Classroom: A Case Study of Collaborative Digital Curriculum," *Research Library Issues*, no. 284 (September 2013): 16–20.

[15] Ed Galloway and Cassandra DellaCorte, "Increasing the Discoverability of Digital Collections Using Wikipedia: The Pitt Experience," *Pennsylvania Libraries: Research & Practice* 2, no. 1 (May 2, 2014): 84–96, https://doi.org/10.5195/palrap.2014.60.

[16] Joy M. Perrin et al., "Know Your Crowd: A Case Study in Digital Collection Marketing," *Reference Librarian* 58, no. 3 (July 2017): 190–201, https://doi.org/10.1080/02763877.2016.1271758.

[17] James Morley, "Use and Impact of Cultural Heritage Images on Wikimedia Commons and Wikipedia," *Catching The Rain* (blog), April 13, 2018, http://www.catchingtherain.com/portfolio/use-and-impact-of-cultural-heritage-images-on-wikimedia-commons-and-wikipedia.

[18] "Wikipedia:GLAM/About," in *Wikipedia*, November 2, 2018, https://en.wikipedia.org/w/index.php?title=Wikipedia:GLAM/About&oldid=866995413.

The proliferation of these projects shows an increasing interest by cultural heritage institutions in working directly with Wiki projects to promote collections and enhance knowledge of archival resources. As Archivist of the United States David Ferriero pointed out, "our work with Wikipedia is not only good enough, it's great for us because it takes our goals of transparency, public participation, and collaboration to a new level."[19]

Since over a decade has passed since the first documented attempt by a cultural heritage institution to link their collections to Wiki projects, it is possible to begin to isolate trends and best practices in these efforts. First, the majority of documented cases have involved large research universities or international museums, many of whom have world-renowned digital collections with a wide appeal. While some of the studies discussed in this literature review detail specific collections linked via Wikipedia, most do not, so it is not clear what types of digital collections or items might most likely result in the large increases in web traffic often reported. Successful attempts to link Wiki projects to digital assets have ranged from single item uploads to hundreds or even thousands of Wiki edits made by cultural heritage employees. In addition, cultural heritage institutions that have undertaken Wiki projects have typically measured success of such efforts by looking at web analytics to their institutional websites and digital collections, though some also look at reuse on other Wiki projects as well as reference requests.

Despite the overwhelming success reported in these projects, there may be barriers or drawbacks to engaging in such work. As Perrin et al. note, cultural heritage institution embellishment of Wikipedia or Wikimedia Commons is a labor-intensive pursuit that may not be feasible for large-scale projects.[20] Several of the cases outlined here also report difficulty in cultural heritage professionals and student workers learning the intricacies of Wikipedia editing, and some ran into significant hurdles in getting their links added without immediate deletion by other Wikipedians.[21] Reports of such experiences are primarily found in the earliest articles detailing such projects, and updates to Wikipedia's policies on "conflicts of interest" as well as dedicated efforts to link experienced Wikipedians with cultural heritage institutions may have diminished some of these concerns.[22]

A recent study by George Cooban provides additional best practices and strategies for cultural heritage institutions planning on working with Wiki projects. Interviews with Wikipedians-In-Residence and cultural heritage professionals were conducted to determine how archivists could

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[19]David S. Ferriero, "On the Growing Relationship Between the National Archives and Wikipedia," *Vital Speeches of the Day* 77, no. 10 (October 2011): 367–69.

[20] Perrin et al., "Know Your Crowd."

[21] Lally and Dunford, "Using Wikipedia to Extend Digital Collections;" Pressley and McCallum, "Putting the Library in Wikipedia;" Zentall and Cloutier, "The Calisphere Wikipedia Project: Lessons Learned."

[22] wittylama, "Conflict of Interest & Archives," *Witty's Blog* (blog), October 1, 2009, https://wittylama.com/2009/10/02/conflict-of-interest-archives.

best work with Wikipedia. The Wikipedians-In-Residence advocated for archivists to improve articles beyond just adding links to collections in the "External Links" section of articles, noting that "although adding links back to their catalogues can be worthwhile for both archivists and Wikipedia, editing articles, uploading content to Wikimedia Commons or investigating Wikidata may be more valuable still."[23] Cultural heritage professionals should see engaging with Wiki projects less as a "tool" for promoting their collections, and more as a "quid pro quo" relationship in which the Wiki edits are of equal benefit to the institution as to Wikimedia project users.

Cooban also notes that qualitative analysis of cultural heritage engagement with Wiki projects is lacking and that most institutions focus on web traffic as a measure of success. Another method for assessing the impact of digital cultural heritage is content reuse and, in particular, image reuse. Reverse Image Lookup (RIL) services like Google Image Search or TinEye can be used by uploading an image or inputting an originating URL to find duplicates and similar images online. Previous RIL research have located instances of image reuse and then analyzed the context and purpose of reuse to help make digitization, marketing, and staffing decisions at cultural heritage institutions with collections ranging from the natural sciences to national library and gallery collections.[24]

Research Methodology

In order to add diversity of institution-type to the existing literature regarding cultural heritage institutions and Wiki projects, as well as to propose additional impact measures for conducting such work, the following study details a project undertaken at [Institution Name] to enhance Wikimedia Commons and related Wikipedia articles by adding digital assets.

[Institution Name]

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[23] Cooban, "Should Archivists Edit Wikipedia, and If so How?," 267.

[24] Elizabeth Joan Kelly, "Reverse Image Lookup of a Small Academic Library Digital Collection," *Codex: The Journal of the Louisiana Chapter of the ACRL* 3, no. 2 (January 27, 2015): 80–92; Isabella Kirton and Melissa Terras, "Where Do Images of Art Go Once They Go Online? A Reverse Image Lookup Study to Assess the Dissemination of Digitized Cultural Heritage | MW2013: Museums and the Web 2013," in *Museums and the Web 2013* (Silver Spring, MD: Museums and the Web, 2013), https://mw2013.museumsandtheweb.com/paper/where-do-images-of-art-go-once-they-go-online-a-reverse-image-lookup-study-to-assess-the-dissemination-of-digitized-cultural-heritage; Kayvan Kousha, Mike Thelwall, and Somayeh Rezaie, "Can the Impact of Scholarly Images Be Assessed Online? An Exploratory Study Using Image Identification Technology," *Journal of the American Society for Information Science & Technology* 61, no. 9 (September 2010): 1734–44, https://doi.org/10.1002/asi.21370; Michele Reilly and Santi Thompson, "Understanding Ultimate Use Data and Its Implication for Digital Library Management: A Case Study," *Journal of Web Librarianship* 8, no. 2 (April 2014): 196–213, https://doi.org/10.1080/19322909.2014.901211; Michele Reilly and Santi Thompson, "Reverse Image Lookup: Assessing Digital Library Users and Reuses," *Journal of Web Librarianship* 11, no. 1 (January 2017): 56–68, https://doi.org/10.1080/19322909.2016.1223573.

Unlike the previous cultural heritage institutions detailed, [Institution] is a medium sized private, liberal arts college with a Master's L Carnegie Classification. [Institution] Special Collections and Archives preserves materials related to the history of [state and region], [religious affiliation], and [Institution] and includes manuscript collections, rare books, microfilm, and digital collections. Digital collections are ingested as part of the [Digital Library], a statewide consortia that uses Islandora as its platform.[25]

Wikipedia and Wikimedia Commons Edits

For this study, several different strategies were undertaken in order to compare and contrast their efficiency and impact. Following tips and best practices identified in the literature review case studies, the author created a Wiki editor account to keep track of edits and uploads. As others have noted, however, if additional [Institution] staff or students begin working with Wikipedia and Wikimedia Commons, additional accounts will need to be created and "watchlists" can be developed to monitor activity related to [Institution] edits.

First, ninety-eight images from three distinct collections were uploaded to Wikimedia Commons. These were:
- Forty-nine images from [Rare Book], a volume published in 1828 containing hand-colored lithographs of medical plants, flowers, and fruits, digitized and available in the [Digital Library][26]
- Forty-six images from the [Institution] University Photographs Collection, comprised of photographs dating back to the early 20th century from [Institution] University Archives, digitized and available in the [Digital Library][27]
- Three images of [Alum], a [Institution] alum and the first female law professor in [Region], digitized and available in an Omeka digital exhibit[28]

All of the images were determined to be in the public domain, and were chosen for the diversity in audience they might attract. [Rare Book] is rare; WorldCat reports that twenty libraries own it, but [Institution's] holding is not unique. It has the potential to appeal to visual artists, scientists, botanists, and Germanic studies scholars, to name a few. The [Institution] University Photographs Collection may have a much smaller potential audience comprised of [Institution] alumni and [Region] history enthusiasts, but the objects are largely unique and reuse of them could easily be traced back to [Institution] holdings if applicable. The [Alum] images are also relatively unique and were chosen as a completed article on [Alum] was not yet available in

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[25] [Digital Library Link]
[26] [Digital Collection Link]
[27] [Digital Collection Link]
[28] [Digital Collection Link]

Wikipedia, and also to contribute to women's history on Wikipedia. The images were uploaded to Wikimedia Commons using the UploadWizard,[29] and metadata was entered manually based on existing metadata in the digital library and exhibit. Links to the [Digital Library] collection or Omeka exhibit for each corresponding digital object uploaded to Wikimedia Commons were included in the Wikimedia Commons metadata.

Prior to uploading to Wikimedia Commons, the Google Image "Search By Image" function was used to find instances of reuse for these same images.[30] The content or purpose of the website where reuse was identified was labeled using content analysis, a quantitative research method.[31]

Next, seven existing Wikipedia articles were edited to include links to six [Institution] digital collections, four individual digital objects, the [Alum] exhibit, and a digital timeline using archival materials hosted on [Institution] website. In addition, an existing [Alum] draft article was completed, and a new article was authored about [Collection Creator]. In sum, the digital collections, objects, exhibits, and timeline linked on Wikipedia included:

[List of Collections and Items][32]

Abbreviated titles for each collection and item are listed in Appendix A [to be inserted later to avoid deanonymization].

Following best practices, Wikipedia page edits included adding links to these collections and items in the External Links sections of Wikipedia pages, adding links in the body of articles, and adding relevant information to the body of articles using digital collection descriptions and finding aids, thus resulting in additional links added to the References sections to articles.

All editing and uploading was completed from July 16-18, 2018.

Analysis

Impact data for the Wikimedia Commons uploads and Wikipedia edits were gathered from several sources after approximately a nine month period, set to roughly correspond with a nine month period of access and use data collected prior to the wiki edits. Wikimedia Commons provides reuse data for image placement on other wikis which was documented for each upload.

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[29] https://commons.wikimedia.org/wiki/Commons:Upload_Wizard

[30] "Find Related Images with Reverse Image Search - Android - Google Search Help," accessed May 10, 2019, https://support.google.com/websearch/answer/1325808?co=GENIE.Platform%3DAndroid&hl=en.

[31] James W. Drisko and Tina Maschi, *Content Analysis*, Pocket Guides to Social Work Research Methods (Oxford University Press, 2015).

[32] All collections and items can be found in the [Digital Library] with the exception of [Digital Exhibit] and [Digital Timeline]

The Google Image "Search By Image" function was used again to find instances of reuse for the newly uploaded Wikimedia Commons images. Google Analytics for the [Digital Library] and the [Institution] library website (which hosts the [Digital Timeline]) were also gathered for the period preceding and following Wiki edits.[33]

Results

Wiki Reuse

Of the ninety-eight images uploaded to Wikimedia Commons, only seven were reused for a total of twelve instances of reuse on Wikimedia Commons and other wikis. One of these was placement by the author of one of the [Alum] images on the newly published Wikipedia article; this article was then duplicated to two non-English wikis and to Wikidata. One of the wiki reuse instances was an incorrect placement of a [Institution] building image on the Wikipedia article for another university. The remainder of file usage on other wikis was comprised of pages auto-generated by Wikimedia Commons such as "new user uploads" and image galleries generated by bots based on image categories.

Google Analytics

Google Analytics pageviews, landing pages, and referrals were analyzed for two time periods-- October 1 2017-July 16 2018, or prior to the Wikimedia Commons and Wikipedia edits; and July 19 2018-April 30 2019 to analyze traffic after the edits. Before any edits were made to Wikis, Wikimedia projects accounted for three percent of traffic referred to all of [Institution's] items and collections in the [Digital Library]. Wiki websites ranked sixth out of fifty-one referring sites to these collections. After Wiki edits were made, Wikimedia projects accounted for four percent of traffic referred to these same collections and items, and Wiki websites ranked fifth out of forty-four referring sites to these collections. However, pageviews for collections and items included in the case study actually saw a decrease of twenty-seven percent after edits to Wikis were made (Figure 1), though individual items linked in Wikipedia articles (as opposed to whole collections, exhibits, or timelines) saw slight increases in pageviews (Figure 2).

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[33] Google Analytics were not available for the [Alum] exhibit as the Omeka version used at the time this project started did not allow Google Analytics. The site has since been upgraded and analytics are available as of February 2019, but there is no comparison data for previous months.

Figure 1: Pageviews for collections linked on Wikipedia or uploaded to Wikimedia Commons
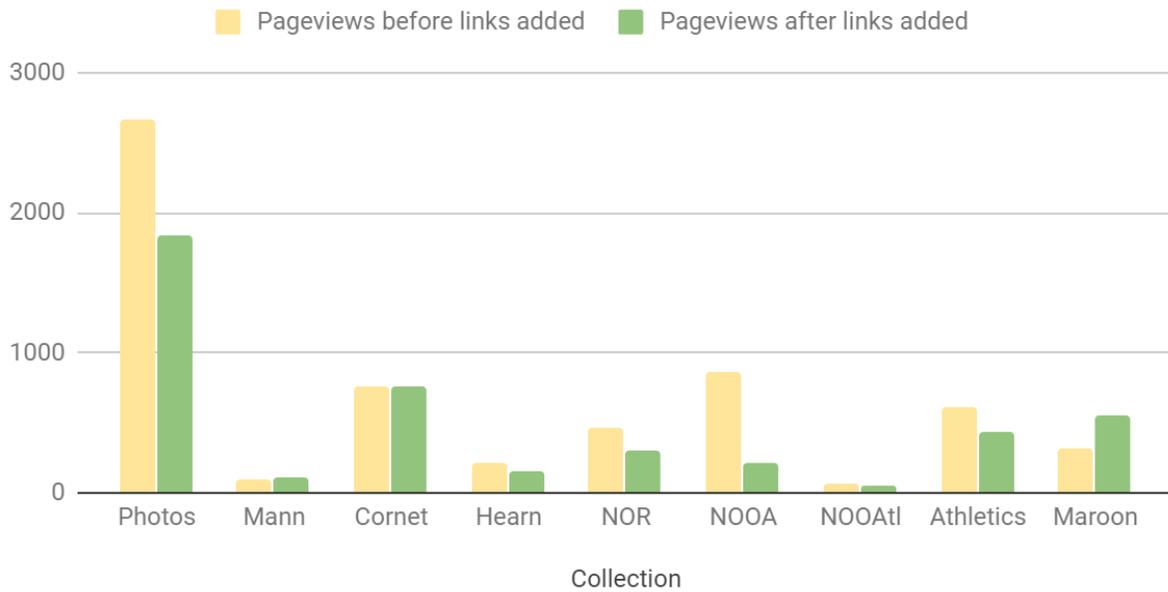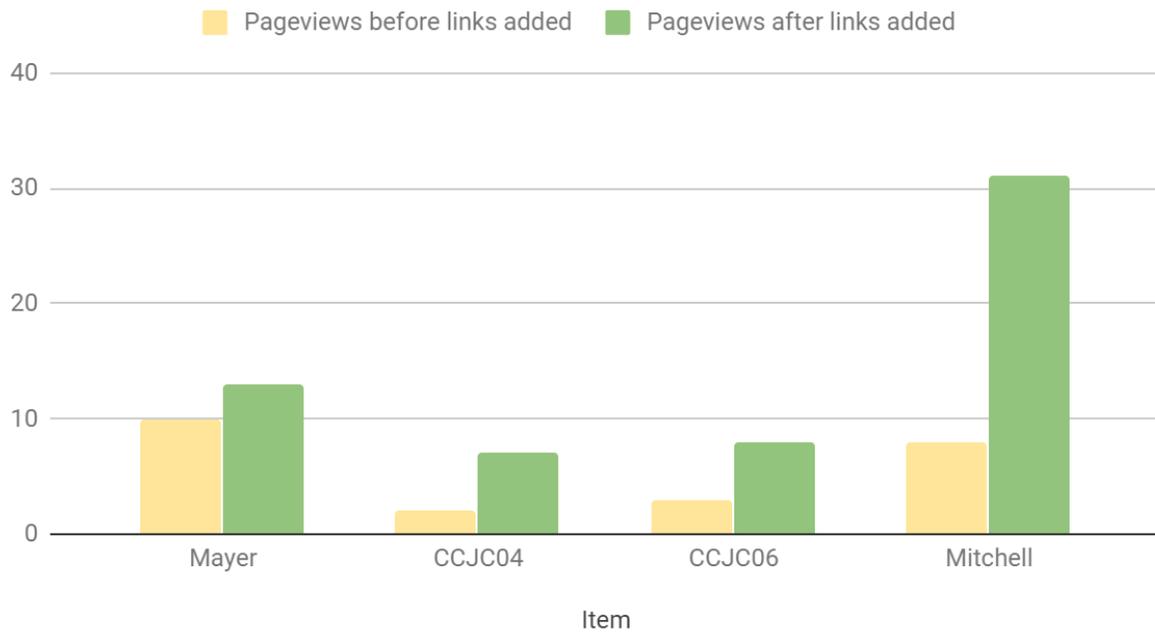

Figure 2: Pageviews for individual items linked on Wikipedia

For comparison, pageview traffic for the entire [Digital Library] increased by ten percent during the same time period, and pageviews for [Institution] collections and individual items increased by eighteen percent.

Though overall traffic from wiki sites to [Institution's] digital collections only saw a very slight increase, sessions in which the landing pages for the digital collections and items added to Wikipedia and Wikimedia Commons were the initial page used to enter the digital library were also analyzed to see if traffic going directly to these pages increased. There was a twenty percent increase in sessions with landing pages for collections and items linked in Wikipedia articles and Wikimedia Commons (Figure 3, Figure 4, Table 1).

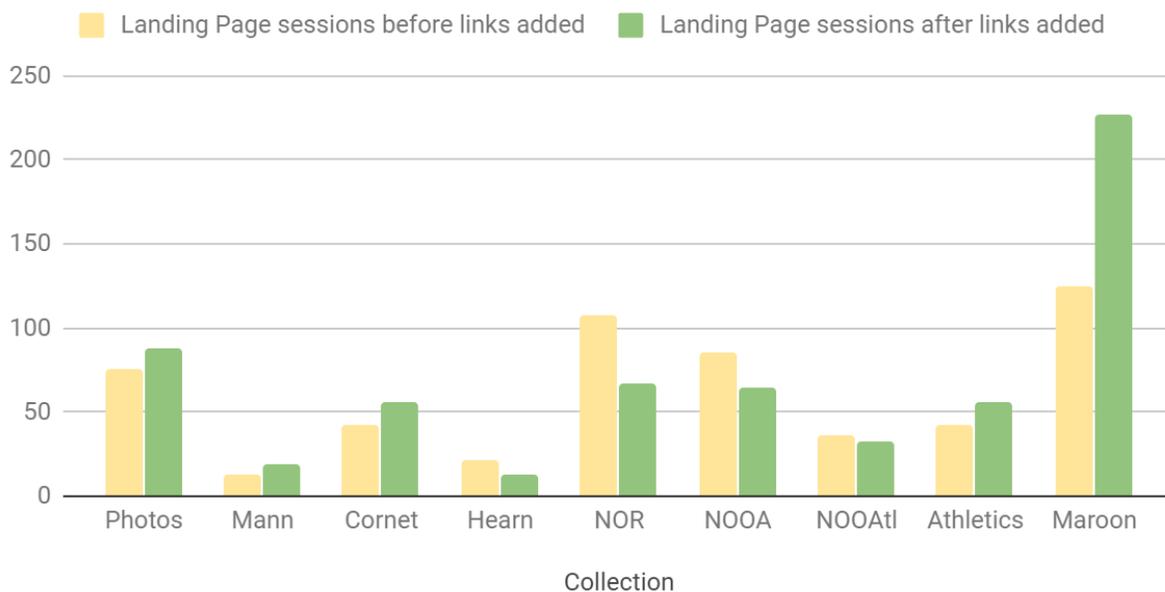Figure 3: Landing Page sessions for collections linked on Wikipedia or uploaded to Wikimedia Commons

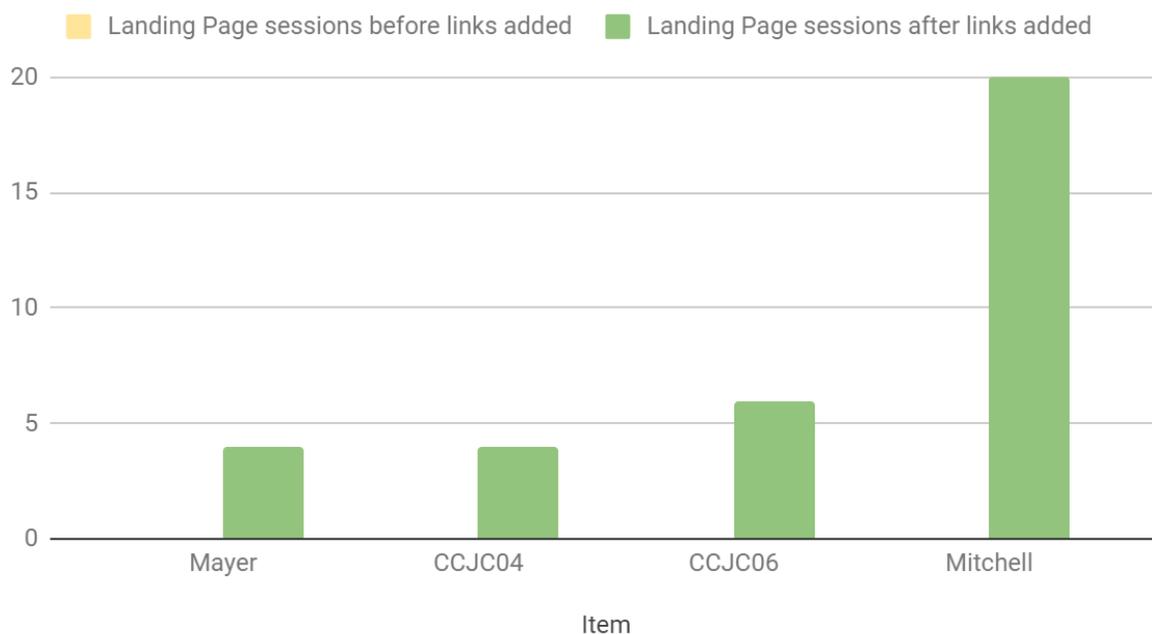## Figure 4: Landing Page sessions for items linked on Wikipedia

Figure 4: Landing Page sessions for items linked on Wikipedia

	Pageviews before	Pageviews after	Landing Page before	Landing Page after
Photos	2659	1833	76	88
Mann	98	105	13	19
Cornet	757	753	43	56
Hearn	220	152	22	13
NOR	466	308	108	67
NOOA	857	212	85	65
NOOAtl	65	50	36	33
Athletics	619	428	42	56
Maroon	317	548	125	227
Mayer	10	13	0	4
CCJC04	2	7	0	4

CCJC06	3	8	0	6
Mitchell	8	31	0	20

Table 1: Pageviews and Landing Page Sessions for collections and items added to Wikipedia and Wikimedia Commons. Yellow highlighting signifies instances in which traffic increased after the edits were made.

Google Reverse Image Lookup

While the addition of [Institution's] digital images to Wikimedia Commons did not increase traffic to [Institution's] digital collections, reuse of these same images outside of the Wikimedia landscape saw a huge increase. Prior to uploading images to Wikimedia Commons, the Google Image "Search By Image" function identified thirteen instances of reuse, four each from the [Institution] University Photographs and [Rare Book], and five for the images from the [Alum] exhibit. Nine and a half months after the images had been uploaded to Wikimedia Commons, Google Image found 130 instances of reuse--a 900% increase--with the largest number of reuse instances using images from the [Institution] University Photographs collection (Figure 5).
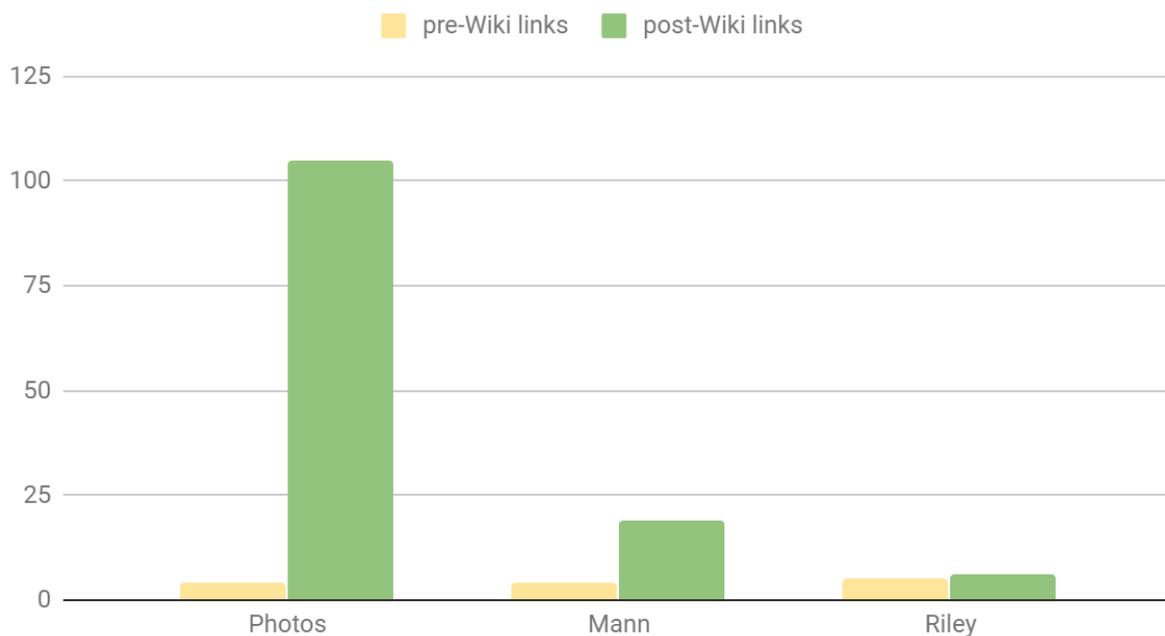

Figure 5: Google Image reuse results before and after Wiki links

Images were primarily reused in media galleries, particularly stock image websites like Alamy that seem to crawl Wikimedia Commons to find freely reusable media.[34] Some of these stock image websites also sell printed or high-resolution copies of the images, so commercial websites were also frequently documented. Social websites like Tumblr blogs also included a significant number of reused images (Figure 6).

Figure 6: Content of websites with reused [Institution] images

education
media gallery
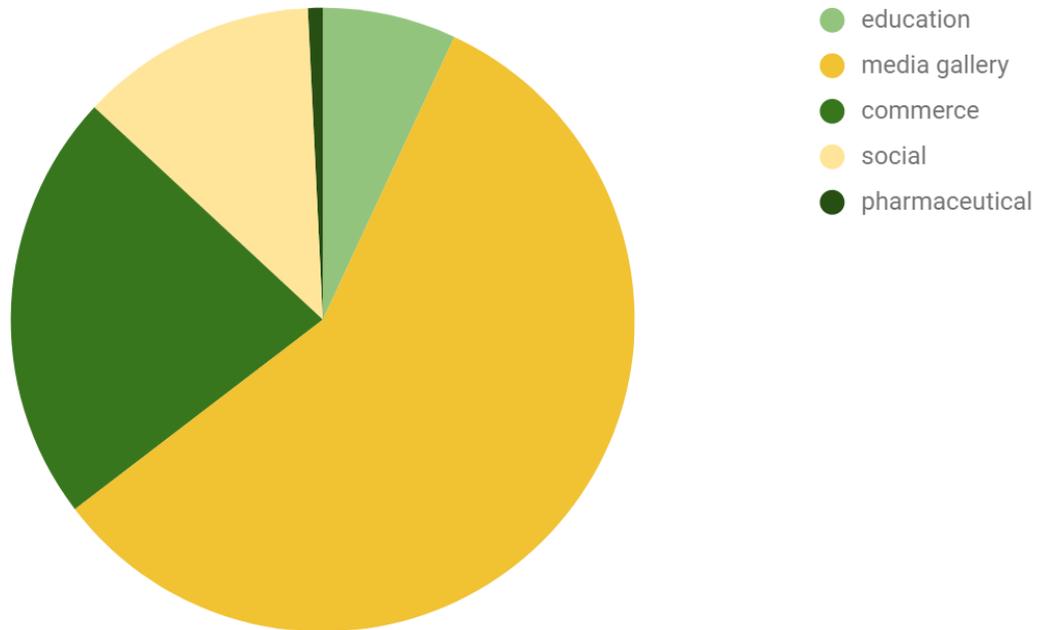commerce
social
pharmaceutical

Figure 6: Content of websites with reused images

[Institution] University Photos saw the biggest increase in reuse, with a 2,525% increase. Reuse of images from [Rare Books] increased by 375%, and [Alum] by 20%.

Discussion

This study found that, while linking digital cultural heritage collections and items in Wikipedia articles did not result in increased traffic to institutional websites and digital libraries, uploading images to Wikimedia Commons did lead to large increases in content reuse outside of Wiki projects. However, this project lays the groundwork for some additional steps that may lead to further engagement with the digital library.

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[34] https://www.alamy.com

Elder, Westbrook, and Reilly discuss the positive results they saw when they not only added images from their collections to Wikimedia Commons but also then added those images to relevant Wikipedia articles, including non-English Wikipedia articles.[35] While the study detailed in this article only used that technique once, placing an image of [Alum] on a newly created article about the pioneering lawyer, doing so did increase reuse both on and off wikis. More efforts of this kind should be undertaken and the web analytics assessed to see if users are more likely to engage with digital cultural heritage images when they're embedded and contextualized in articles, rather than just within Wikimedia Commons.

The same study from Elder et al. recommends adding additional specific categories to images uploaded in Wikimedia Commons in order to increase visibility.[36] While the categories originally used for the Wikimedia Commons uploads in this study were selected based on broad assumed interest areas, there are likely countless other categories that could increase the likelihood that users find [Institution] uploaded images while browsing Wikimedia Commons. Additional reuse assessment using Google Image might also reveal whether the number and specificity of categories used for Wikimedia Commons images has an impact on reuse volume.

Reuse of [Institution] University Photographs Collection skyrocketed after the selected images were uploaded to Wikimedia Commons. Unlike the other two collections selected for Wikimedia Commons uploads, [Institution] Photographs are a largely unique collection that was suspected to have a niche audience. However, the large increase in reuse might point to wider appeal of these images than was initially assumed.

Since pageviews on [Institution] digital library collections for images uploaded to Wikimedia Commons decreased after they were added, does that mean that users are finding what they need through Wikimedia Commons and therefore don't need to access the digital library? Or would better, more thorough metadata for the items in Wikimedia Commons lead users to want to search the [Digital Library] for related items? And why did access for [Institution] collections in the [Digital Library], and for the collections cited on Wikipedia articles, decrease? Further monitoring of web analytics is necessary to see if the decrease in pageviews for collections and items linked to wikis is an anomaly.

This case study involves a relatively small number of collections and objects added to Wiki projects. Some of the projects detailed in the case study resulted in hundreds of Wikipedia articles edited, so volume of edits may also correspond to volume of increased engagement (though others saw impressive results with a single upload to Wikimedia Commons, so more research is needed to back this theory). As some of the other cultural heritage institutions discussed previously saw success working with student workers to develop wiki editing

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[35] Elder, Westbrook, and Reilly, "Wikipedia Lover, Not a Hater," 42.

[36] Ibid.

programs, [Institution] might benefit from embedding wiki editing in coursework or work study assignments to expand on this program.

Finally, while web analytics and image reuse give some sense of the quantitative and qualitative effects of connecting digital cultural heritage to Wiki projects, the benefit to users of Wiki projects is much more difficult to assess. James Morley's "impact factor" measurement for images uploaded to Wikimedia Commons attempts to tackle this, but how can the benefit of additions to Wikipedia articles be measured? Wikipedia provides some tools for this, such as the ability to thank another Wikipedian for their edits, but this is anecdotal at best. As reported by The Wikimedia Foundation "Supporting Commons contribution by GLAM institutions" research project (GLAM standing for Galleries, Libraries, Archives, and Museums), "donating media to Commons is a means to an end. GLAM organizations and the volunteers who work with them want to know the media they upload is being used, and to be able to evaluate the impact of their donations against institutional goals."[37] If the goal of cultural heritage institutions working with Wikis is to improve access to knowledge and cultural heritage (rather than to increase web traffic), how can institutions determine whether they're succeeding? Perhaps tracking scholarly, student, and web citations to Wikipedia articles enhanced by information from cultural heritage collections could provide some insight; or further interviews with Wikipedia users as to how the content of Wikipedia could be improved by cultural heritage institutions; or even assessment of the quality of Wikipedia articles with and without cultural heritage additions could be starting points. Regardless, further qualitative research is needed, as is the development of best practices and tips for this type of assessment.

Conclusion

The results of this study show that increases in web traffic to digital collections and websites for cultural heritage institutions may not always occur after linking to collections and digital libraries on Wikipedia, possibly (and in particular) for smaller institutions and those with niche collections. However, uploading images to Wikimedia Commons resulted in much greater reuse of these images outside of Wiki projects, so cultural heritage institutions hoping to connect to more users may find success in this method. This article provides details on how cultural heritage institutions can begin a Wiki editing project as well as a variety of ways to assess the impact of such an undertaking. These techniques add to the body of existing research in this field and augment the use of web analytics, the assessment tool currently most adopted by cultural heritage professionals. The addition of new methods for assessing the impact of digital cultural heritage collections gives greater awareness of successful marketing and outreach efforts to cultural heritage professionals. While more case studies and research on the efficacy of linking

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[37] "Research:Supporting Commons Contribution by GLAM Institutions," Wiki, Meta-Wiki (blog), December 10, 2018, https://meta.wikimedia.org/wiki/Research:Supporting_Commons_contribution_by_GLAM_institutions.

digital cultural heritage on Wiki projects, specifically for institution types less represented in the literature, is still needed, this article paves the way for more projects such as this to be initiated.

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Appendix A

[Names of Collections and Items with Abbreviated Code Names]